

**Resource Conservation and Recovery Act (RCRA) Corrective Action
Determination of Remedy Decision
RCRAInfo Code CA400**

Facility Name: Army Garrison-Fort Buchanan
Facility Address: Bayamón, Puerto Rico
Facility EPA ID No.: PR1210099999

Facility Information

The Army Garrison Fort Buchanan (facility) is located approximately 10 kilometers southwest of San Juan, Puerto Rico. The facility is bordered by Roosevelt Avenue to the east, road PR-No. 2 to the south, road PR-No. 28 to the immediate northwest (with Puma Energy Caribe LLC beyond) and De Diego Expressway to the north. The facility occupies approximately 746 acres within two municipalities, Bayamón and Guaynabo. Physiographically, the facility is located on the northern coastal plain of Puerto Rico, which is about 5 miles wide and slopes gently upward to the central mountain chain, the Cordillera Central (Ref. 1).

The facility was established in 1923 under the name of Camp Buchanan, originally located on a 300-acre tract of land approximately six miles south of San Juan Bay. From 1926 to 1930 Camp Buchanan was used as a maneuver training area and range by the regular Army, by National Guard troops, and as a Citizen Military Training Camp (Ref. 1). In 1940 it was designated as Fort Buchanan and expanded to 1,514 acres, later expanding to 4,500 acres. After World War II, the facility was gradually reduced in size to its present 746 acres. Today, Fort Buchanan continues to support the reserve- and active-component soldiers in Puerto Rico and the U.S. Virgin Islands. From 1966 to 1971, Fort Buchanan was under the command of the U.S. Navy. In 1972, the Army resumed command and placed the U.S. Army Garrison, Fort Buchanan under the control of U.S. Army Forces Command. On October 1st, 2005 Fort Buchanan began a one year transition into the U.S. Army Reserve in accordance with the Puerto Rico Island-Wide Garrison Concept Plan of 12 May 2004. Fort Buchanan's mission is to provide standardized services and sustainable infrastructure in support of the Armed Forces and the diverse Fort Buchanan community (Ref. 1).

According to the geologic maps of the Bayamón Quadrangle and the San Juan Quadrangle (Ref. 2 & 3), the coastal plain, wherein the facility lies, consists of unconsolidated deposits of Quaternary Age alluvium sands, silts, and clays which characterize the northern two-thirds of the surface geology of the facility and most of the relatively flat central valley of the facility areas. A range of Neogene age limestone (Aguada) outcrops, known as Montes de Caneja, occurs along the northern boundary of the facility, and a second ridge, which is part of the Cibao formation, forms the southern boundary. The Cibao Formation stratigraphically underlies the Aguada Formation.

Data obtained during the Northwest Boundary Groundwater Site (NWBGS) RCRA Facility Investigation (RFI) indicates that, while not uniform across the facility, approximately 20 to 40 feet (ft) of clay overburden was encountered prior to contact with the uppermost carbonate sand aquifer (Ref. 4). The overburden tended to thicken as the investigation moved northward. Underlying the clays and silts were varying degrees and ranges of a carbonate sand unit comprised of fine to large gravel and coarse sands, mostly yellow to pale brown in color (Ref. 4). Beneath

the water table, these zones were mostly saturated. In many of the wells, two distinct carbonate zones (older and younger terrace zones) were found separated by approximately two to 20 ft of fine material (Ref. 4). However, data gathered during the installation of the seven northernmost wells suggested one carbonate sand layer north of the site. Underlying the carbonate layer was often a greenish gray silt material.

The hydrogeology of Fort Buchanan consists essentially of a two-aquifer system that is connected, with the older terrace being the source for the recharge of the younger terrace. The older terrace occupies the southern end of the study area in the uplands, while the younger terrace represents the northern lowlands (Ref. 4). Both aquifers are in the carbonate sands. Low-permeability overburden covers the area; thereby preventing, or limiting, infiltration in the study area (Ref. 4). The upland area to the south provides recharge to the study area. The overburden thins out in the southern uplands, and the aquifer surfaces there to recharge (Ref. 4). The older terrace material consists of alternating sand and silt, and dips below the younger terrace material. It has a strong, immediate response to rain events, and is not affected by tides (Ref. 4). The younger terrace, alternatively, forms the northern half of the study area. It communicates with the older terrace, but not excessively. It is also an alternating sand/silt one-to-two aquifer system. The wells within the younger terrace have a lesser response to rainfall, and are affected by tides (Ref. 4). Groundwater flows south to north, with a steep gradient from the southern end of the investigation area and flattening out north of the former Directorate of Public Works (DPW) complex and across Route 28 (Ref. 4). Groundwater levels are tidally influenced in many of the wells.

Summary of Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs):

Several environmental investigations have been conducted at Fort Buchanan that helped identified the SWMUs and AOCs. These include an Army Installation Assessment in 1984 (Ref. 5); a RCRA Facility Assessment (RFA) completed by the Puerto Rico Environmental Quality Board (PREQB) in 1991 (Ref. 6); RCRA Closure documents for the Pesticide Shop at Building 596 (Ref. 7); an Environmental Baseline Study (EBS) by the Army in 1997 (Ref. 8); and a geohydrological study of the Old Landfill completed by the Army in 1999 (Ref. 9); among others. The RFA identified five SWMUs and one AOC; the EBS identified nine more areas of potential contamination. A number of previous investigations have been conducted specifically at SWMU 3. The SWMUs and AOCs are listed below:

- Site 1, SWMU 1: Old Hazardous Waste Containers
- Site 2, SWMU 3: Pesticides and Chemicals Burial trench
- Site 3, SWMU 4: Spent Solvents Storage Area
- Site 4, SWMU 5: PCB Transformer Storage Area #1
- Site 5, SWMU 6: PCB Transformer Storage Area #2
- Site 6: Pesticide Storage Area
- Site 7: Building 541
- Site 8: Building S-563
- Site 9: Used Oil Staging Area
- Site 10: 65th Army Reserve Command Refueling Area
- Site 11: Heavy Equipment Storage Area
- Site 12: Old Landfill

Site 13: Potential Hazardous Material Burial Site
Site 14: Small arms firing range (Non RCRA)
Site 15: Building S-159
Northwest Boundary Groundwater Site (NWBGS)

Of the 16 sites identified, 15 are addressed within the RCRA Corrective Action Program. One of the sites (Site 14: Small Arms Firing range) is being addressed within the confines of the Military Munitions Response Program (MMRP) and is known as the Camp Buchanan Training Area (Ref. 1 & 10).

Ft. Buchanan engaged in a voluntary corrective action after volatile organic compounds (VOCs), primarily trichloroethylene (TCE), were detected in groundwater monitoring well samples collected within the adjacent property (now Puma Energy Caribe LLC) in 2004. As a result, the US Army Environmental Command (AEC) conducted two separate RFIs (Ref. 1 & 4); one to determine the nature and extent of groundwater contamination at the Northwest corner of the facility, (aka “Northwest Boundary Groundwater Site”) and another to determine the nature and extent of potential contamination resulting from former activities at the 14 SWMUs and AOCs (aka “Site-wide”).

For the NWBGS, EPA has already reached a Remedy Decision in 2012 (Ref. 11). Of the remaining 14 SWMUs and AOCs, only Sites 2, 3, 9, 11 and 12, exceeded the metals screening criteria for industrial soil (Ref. 1 & 12).

Remedial Approaches

Northwest Boundary Groundwater Site

Groundwater within the NWBGS contains TCE and tetrachloroethylene (PCE), and to a lesser extent 1,2-dichloroethylene (1,2-DCE) and vinyl chloride. The horizontal extent of elevated concentrations of PCE, 1,2-DCE, and vinyl chloride is generally limited to the facility; notable concentrations of these analytes have not been detected north of the installation (Ref. 4). The horizontal extent of TCE is more widespread and extends north from the facility boundary. The compound most frequently detected in groundwater during the sampling events was also TCE. Results of the NWBGS RFI indicate that the area of highest TCE concentrations in groundwater is within an open field area east of the DPW complex (4,040 µg/L). VOCs were detected in off-post monitoring wells north of the installation, with TCE detected at concentrations up to 141 µg/L. Soil samples were collected from soil borings and test pits during the NWBGS RFI. No VOCs were detected above screening levels in any of the soil samples (Ref. 4).

The risk assessment determined there are no potential concerns for human contact to soil and surface water within the NWBGS. For the commercial and construction worker, there are potential concerns for inhalation of indoor air from vapor intrusion (Ref. 13). As noted above, there are currently no buildings within the NWBGS that are occupied on a regular basis. However, any buildings constructed within the NWBGS should take into account potential vapor intrusion of VOCs from groundwater to the indoor spaces. There are potential risk concerns for off-site resident exposure to groundwater as a drinking water source. At the moment, no drinking water wells exist

off-site. The primary contributor to groundwater concerns is TCE. No ecological risks have been identified at the NWBGS.

Remedy selected for the NWBGS consists of a combination of Enhanced Bioremediation – Reductive Dechlorination, Long-term Monitoring, and the establishment of Land-Use Controls (LUCs) (Ref. 11). This alternative involves enhanced bioremediation via anaerobic dechlorination using substrate, electron donor, and nutrient injection (as required) to address areas of the greatest groundwater impacts, a long-term monitoring program to assess trends in natural attenuation and contaminants of concern (COCs) in groundwater over time, and LUCs prohibiting the use of groundwater as a source of drinking water until the COCs in groundwater are below the remedial goal and requiring vapor mitigation for any new structures, as necessary, to prevent exposure to the COC above indoor air levels due to vapor intrusion (Ref. 11).

The bulk of the remediation of the COCs at the NWBGS would occur during the enhanced bioremediation phase of the remedy. Enhanced bioremediation was selected to accelerate degradation of the COCs in the area of the highest concentrations. The interim remedial goal for this phase of the remedy is 100 µg/L for TCE, which is expected to result in achievement of the final remedial goal of 5 µg/L for TCE within a reasonable timeframe of 30 years. Long-term monitoring would be conducted to ensure that COCs continue to attenuate and that the remedial goals are achieved. Periodic reviews would be conducted, because the COCs would be present in groundwater at concentrations that exceed the remedial goal after implementation of the enhanced bioremediation portion of the remedy and before attenuation of the COCs to the remedial goal is complete.

Site-wide

Of the 14 SWMUs and AOCs investigated, only Sites 2, 3, 9, 11 and 12, exceeded the metals screening criteria for industrial soil (Ref. 1 & 12). Maximum detected concentrations are presented below (Ref. 1 & 12):

Metal	Background (mg/kg)	Maximum Detected Concentration (mg/kg)				
		Site 2	Site 3	Site 9	Site 11	Site 12
		Subsurface	Subsurface	Subsurface	Subsurface	Surface
Aluminum	30,027	Not reported	32,200	23,400	25,300	19,100
Arsenic	43.87	45.4	122	166.1	119	7.9
Chromium	69.8	72.4	89.3	184	140	27.2
Cobalt	16.57	0.75	45.3	104	23.7	9.4
Iron	47,064	ND	95,300	127,000	70,000	23,400
Manganese	1,184	ND	12,800	7,150	3,040	406
Vanadium	145	202	291	232	241	77.6

The results of the Human Health Risk Assessment (HHRA) indicate Sites 2, 3, and 11 have potential concerns for non-carcinogenic risk for the resident child and potential carcinogenic risks for the hypothetical lifetime resident. Therefore, the Site wide RFI recommended Sites 2, 3 and 11 be carried into the Corrective Measures Study (CMS). There are no exceedances of the carcinogenic or non-carcinogenic risk thresholds for current users, the adult and adolescent

trespasser, and commercial worker at Sites 2, 3, and 11. Metals that contribute to the risk include arsenic and total chromium for the carcinogenic risk, and arsenic and manganese have non-carcinogenic hazards above 1. It was noted that chromium was assumed to be hexavalent chromium since chromium was not speciated during the Site wide RFI. Manganese may present potential risk concerns for residential receptors at grouping of Sites 2, 3 and 11.

For Site 9, the risk assessment concluded that there are non-cancer risk concerns for construction workers for manganese. Additionally, the risk assessment concluded that there are potential risk concerns for residential exposure to arsenic, total chromium, iron, and manganese in subsurface soil and that exposure to cobalt present in soil is not a concern with regard to risk.

For Site 12, the results of the HHRA in the Site-wide RFI indicate that there are no risk concerns. Therefore, there were no potential concerns for receptors at Site 12.

The Ecological Risk Assessment determined that there are no unacceptable risks to plants, soil invertebrates, or wildlife under current exposure scenarios at Sites 2, 3, 9 and 11. The ecological risk assessment for Site 12 found that metal detections do not pose a risk to plants and soil invertebrates due to concentrations being consistent with background.

Since Sites 2, 3, 9, 11, and 12 will remain in their present states as industrial-use sites (Ref. 14) or endangered species habitat, the preferred alternative includes “No Action with Monitoring of Land Use” to assure no changes in the way the sites are used (Ref. 12):

- Site 2 is zoned for community land use and is being developed for non-residential land use with newly constructed buildings and parking lot for the Army National Guard usage.
- Sites 3, 9 and 11 are zoned for industrial land use and are undergoing active construction for solar panels and carports with asphalt covering for use as parking.
- Site 12 is zoned for community land use. Fencing and vegetation currently limit access to the site.
- The Army maintains policies for LUCs and procedures to prevent residential land use in the future without Army approval and acceptance at all sites included in this CMS (Ref. 14).

Public Participation

On June 19, 2012, a notice inviting the public to comment on the proposed remedy for the NWBGS was published by EPA on the *Primera Hora* newspaper. A 45-day public comment period on the proposed remedy was opened from June 19 to August 2, 2012. No public meeting was necessary since it was not requested by the public and no comments on the proposed remedy were made.


For Sites 2, 3, 9, 11 and 12, a notice inviting the public to comment on the proposed remedy was published by EPA on the *El Nuevo Día* newspaper on July 9, 2015. The Army published additional notices, in both English and Spanish, on the same newspaper on July 15, 2015. A 30-day public comment period on the proposed remedy was opened from July 27 to August 27, 2015. A public meeting was also held in the San Juan Marriot Hotel on August 6, 2015. There were fourteen (14)

people that attended the meeting. The attending were representatives from EPA, PREQB, AEC-Texas, US Army Corp of Engineer Jacksonville District, US Army Garrison Fort Buchanan Environmental Office, and, contractors and subcontractors in the Fort Buchanan community. No comments from the public were received.

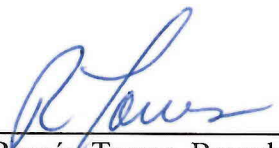
Determination of Remedy Decision (CA400) granted

Based on a review of the information referenced in this document, a determination about "Remedy Decision" has been granted. Sites 2, 3, 9, 11, 12 and the NWBGS will remain in their present states as industrial-use sites (Ref. 14) and LUCs will be monitored to assure no changes in the way the sites are used (Ref. 12). In addition, for the NWBGS, Corrective Measures Implementation (CMI) started on May 2015 and the construction and installation of equipment, bacteria and nutrients injections were finalized on July 2015 (Ref. 15). On December 2015, Ft Buchanan submitted the Final CMI Report for the NWBGS (Ref. 15).

This determination is expected to be maintained at the Army Garrison Fort Buchanan Site, EPA ID# PR1210099999, located in Bayamón, Puerto Rico, under current and reasonably expected conditions. This determination will be re-evaluated when the Agency/State becomes aware of significant changes at the facility.

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Date: 3/1/16

Locations where references may be found:

References reviewed to prepare this EI determination have been identified under the Facility Information Section. Reference materials are available at U.S. EPA, Region 2 and at Ft. Buchanan.

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